

Switching flows: from material to energy leading to new approaches for renovations

Buildings contribute significantly to greenhouse gas emissions. In the near future buildings have to be operated without production of greenhouse gases in order for sustainable living. For the industrialized countries this target must mainly be met by transformation of the existing building stock.



A true holistic approach for sustainable renovation has to consider energy as well as material flows, both at time of construction and during operation. This concept demonstrates that material flows can be substituted by active components that utilize energy. This is shown in an example building at the ETH Zurich which is being renovated in 2010.

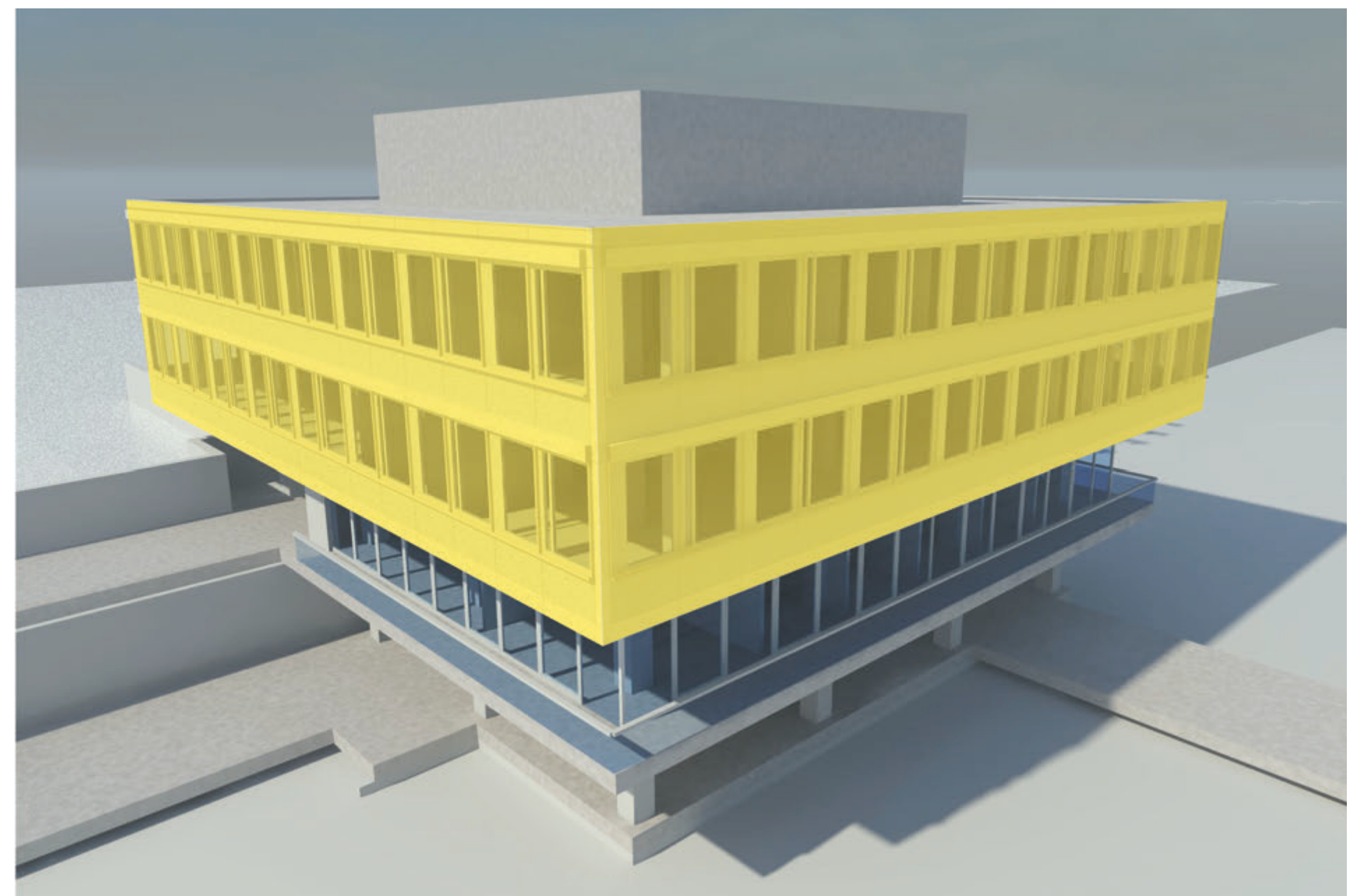
Concept

The conventional way for refurbishing considers energy losses. Those losses have to be minimized, which is often done by core and shell renovation. This creates flows of new materials and waste streams, which are connected to environmental impacts and emissions.

For elements that are structurally intact but have a bad energetic performance it would be better to “upgrade” them by using a combination of active and passive components. That way material consumption can be reduced by more effective energy utilization. The energy is supplied by electricity from renewable sources making the building emission free.



Office building at ETH Zurich

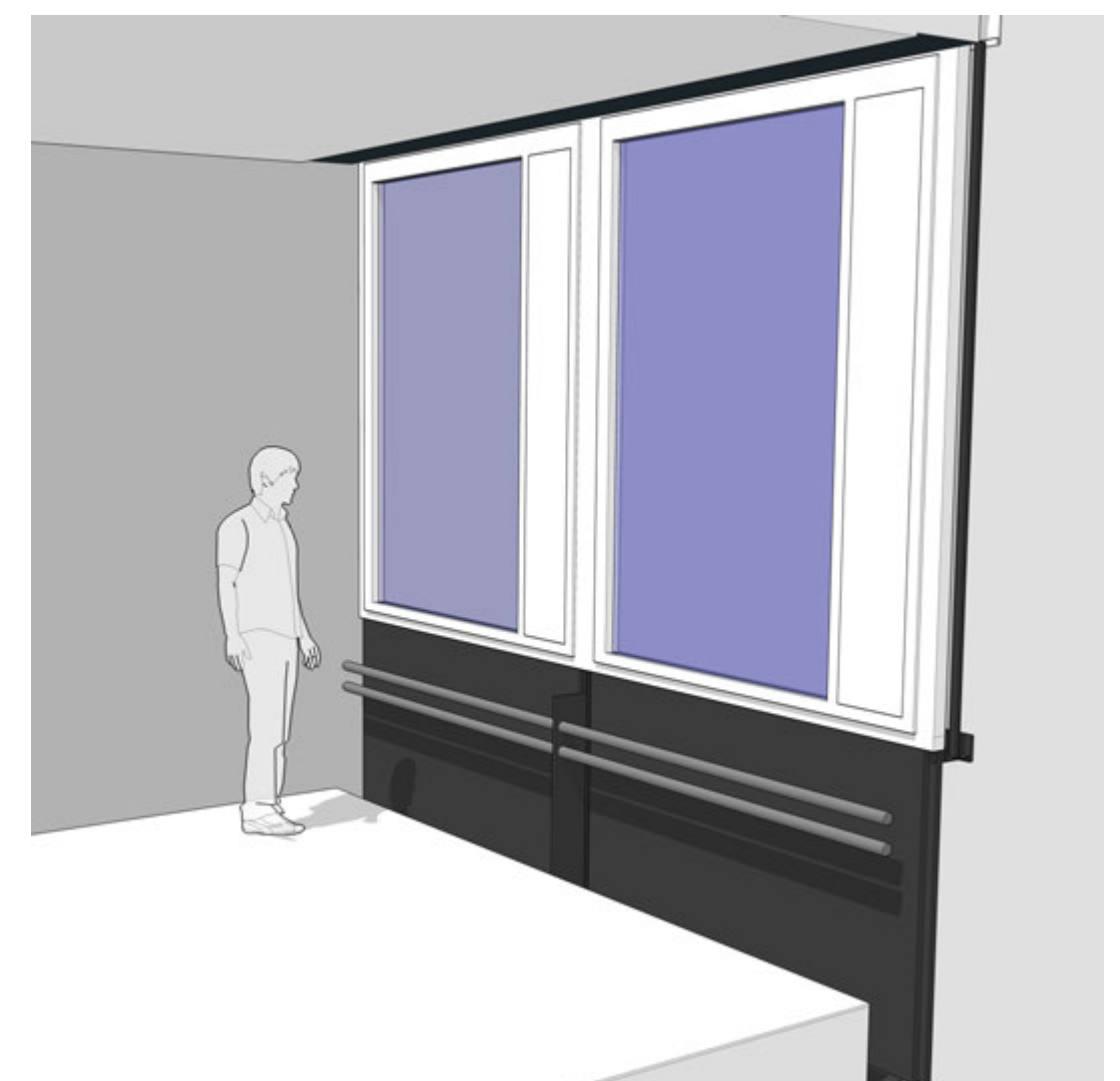


Facade under investigation

Example

The example is a 40 year old office building at the campus of the ETH Zurich, which needs to be renovated. The original planning consisted of a core and shell renovation. Considering material and energy allows some elements to be kept and simply improved. The facade, for example, is easily upgraded with a casing and a decentralized air intake on the interior.

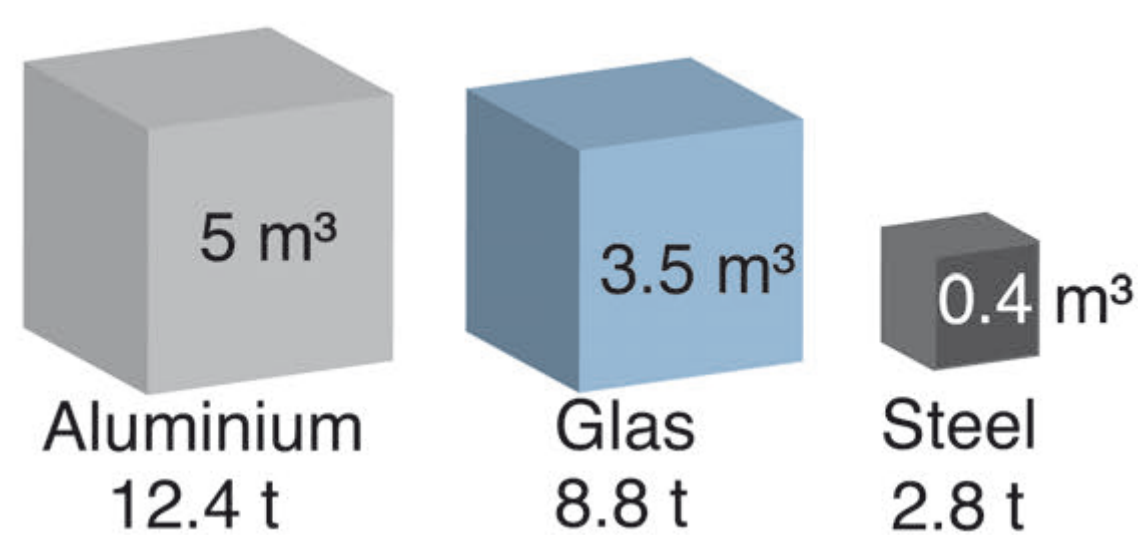
This results in savings of a considerable amount of waste material, especially aluminium. In addition the alternative concept is cheaper, even when additional costs for electricity from PV is considered.



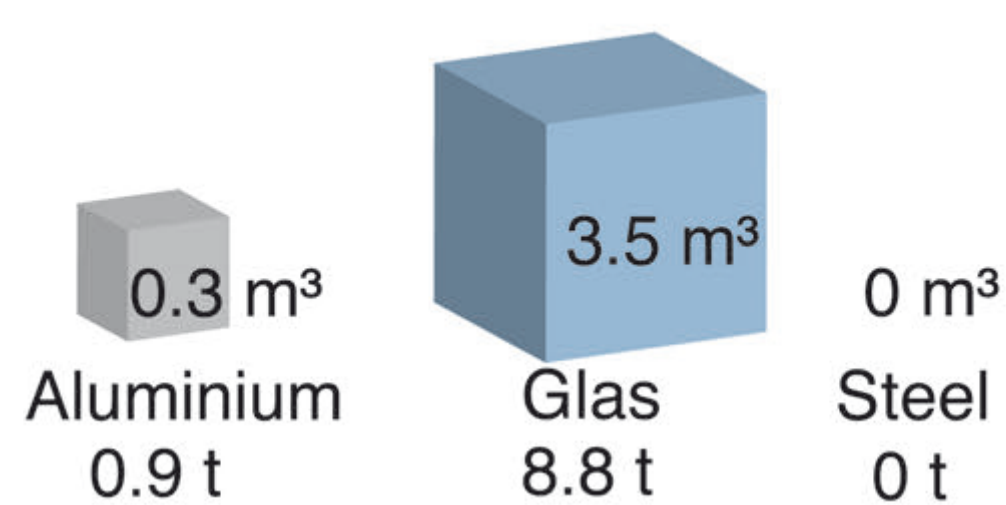
Interior of facade without casing



Interior of facade with new casing and decentralized air intake



Waste for core and shell renovation (facade only)



Waste with retention of facade (facade only)

Conclusion

When renovation strategies aim at reducing energy and material flows, new possibilities for sustainable renovation arise. Those concepts can be sustainable in different ways:

- Economic efficiency: only easy improvements are carried out; a renovation becomes even more economical with decreasing electricity production costs
- Ecological quality: the amount of unnecessary waste is reduced and obstacles for renovations are reduced thereby increasing the number of renovated buildings.
- Socially: costs for achieving sustainable living can be reduced and made affordable for a wider range of people since costs can be shifted from investment to operation and overall costs are lower.